CLAIMS

Having thus described the aforementioned invention, we claim:

1. An arch support orthosis having an arch curve being adjustably tensioned during use, said arch support brace being fittable proximately under a foot and being sized and shaped to be removably placed within a foot support enclosure worn by a user, comprising:

an arch support orthosis being sized for support of the foot from underneath about the metatarsal bones of the foot, to underneath about the calcaneus bone of the foot, said orthosis having a first surface being contoured for support of the foot, having a second surface being downwardly faced for contact with the foot supporting surface of the shoe, and having a medial side and an outer lateral side on opposed sides of a central longitudinal midline of said orthosis;

a forefoot portion of said first surface being arcuately shaped to be positionable underneath the metatarsal bones of the foot;

a heel portion of said first surface being arcuately shaped to be positionable underneath the calcaneus bone of the foot;

a medial longitudinal arch curve proximate said medial side of said orthosis, said medial longitudinal arch curve being shaped to be positionable underneath the arch of the foot, said medial longitudinal arch curve having an upper surface being curved upwardly along a crown portion, said medial side being disposed in a continuous arched curve along a length dimension of said medial side of said orthosis, said medial

longitudinal arch curve including:

an anterior slope being inclined from said upper surface of said medial longitudinal arch curve toward said forefoot portion of said orthosis;

a posterior slope being inclined from said upper surface of said medial longitudinal arch curve toward said heel portion of said orthosis;

a medial slope being inclined from said upper surface of said medial longitudinal arch curve toward said lateral side of said orthosis; and

a means for tensioning said medial longitudinal arch curve connectable between an underside portion of said anterior slope and an underside portion of said posterior slope, said means for tensioning having a means for adjusting manipulated by a user for adjustment of said means for tensioning between a neutral length, a decreased length, and an extended length between said anterior slope and said posterior slope,

whereby when the neutral length of said means for tensioning is reduced to the decreased length by the user adjustment of said means for adjusting, the tension along said medial longitudinal arch curve is increased thereby the stiffness of said arch curve increases from when said means for tensioning is at the neutral length, and each slope of said anterior slope and said posterior slope is increased, and when the neutral length of said means for tensioning is increased to the extended length by the user adjustment of said means for adjusting, the tension along said medial longitudinal arch curve is decreased, and each slope of said anterior slope and said posterior slope is decreased.

2. The arch support orthosis of Claim 1 wherein said means for tensioning including:

an anterior bracket being L-shaped, said anterior bracket having a distal portion being connected under said anterior slope proximal to said medial side, said anterior bracket having a proximal portion extended downwardly from said anterior slope;

a posterior bracket being L-shaped, said posterior bracket having a distal portion being connected under said posterior slope proximal to said medial side, said posterior bracket having a proximal portion extended downwardly from said posterior slope;

an anterior linkage aligned with said anterior bracket, said anterior linkage having a distal end pivotably connected with said proximal portion of said anterior bracket, said anterior linkage having a proximal end disposed underneath said crown portion of said medial longitudinal arch curve;

a posterior linkage aligned with said posterior bracket, said posterior linkage having a distal end pivotably connected with said proximal portion of said posterior bracket, said posterior linkage having a proximal end disposed underneath said crown portion of said medial longitudinal arch curve; and

said means for adjusting the neutral length between said distal end of said

anterior linkage and said distal end of said posterior linkage, said means for adjusting having opposed ends being disposed to accept therein respectively said proximal ends of said anterior linkage and said proximal linkage, said means for adjusting being manipulated by the user;

whereby said anterior linkage and said posterior linkage are retracted into respective opposed ends of said means for adjusting by manipulation of said means for adjusting, the length between said respective distal ends is shortened, each of said anterior and posterior linkages engage said each respective proximal portions of said anterior bracket and said posterior bracket, thereby each respective anterior and posterior brackets pivot respectively inwardly, thereby pulling said underside of said anterior slope and said posterior slope toward each other and increasing the tension along said medial longitudinal arch curve;

whereby when each of said anterior linkage and said posterior linkage is extended from said means for adjusting by manipulation of said means for adjusting, the length between said respective distal ends is lengthened, thereby each distal end extends against said respective proximal portions of said anterior bracket and said posterior bracket which pivot against the underside of said anterior slope and said posterior slope, thereby pushing said underside of said anterior slope and said posterior slope apart and reducing the tension of said medial longitudinal arch curve.

3. The arch support orthosis of Claim 1 further comprising said anterior slope having an anterior base of a first thickness, said posterior slope having a posterior base of a second thickness, said crown of said medial slope having a third thickness along said upper surface of said medial longitudinal arch curve, whereby said anterior base and said posterior base providing rigidity for said medial longitudinal arch curve for repetitive adjusting of said means for tensioning without failure during use by heavily weighted users.

4. The arch support orthosis of Claim 1 wherein said means for adjusting being repeatably manipulated by the user for repetitive extension and retraction of said anterior linkage and said posterior linkage.

5. The arch support orthosis of Claim 1 wherein said means for adjusting including a rotatable adjusting means having a sleeve nut, a worm gear, or a turnbuckle.

6. The arch support orthosis of Claim 1 wherein said means for tensioning including:

said anterior bracket having a distal portion being connected under said anterior slope proximal to said medial side, said anterior bracket having a proximal portion extended downwardly from said anterior slope;

said posterior bracket having a distal portion being connected under said posterior slope proximal to said medial side, said posterior bracket having a proximal portion extended downwardly from said posterior slope;

an anterior means for adjusting connectable at an anterior swivel joint to said anterior bracket, and

a posterior means for adjusting connectable at a posterior swivel joint to said posterior bracket, said anterior adjusting means and said posterior adjusting means having a length of cable connectable therebetween, said length of cable having at least one swivel portion along said length of cable, each of said anterior means for adjusting and said posterior means for adjusting being rotatably manipulated by the user to retract or extend the length of cable between each respective means for adjusting;

whereby when either of said anterior means for adjusting and said posterior means for adjusting is rotatably manipulated, the length of cable is adjustable in length, with resultant increase in tension and angles of said anterior slope and said posterior slope when said length of cable is reduced in length, and with resultant decrease in tension and angles of said anterior slope and said posterior slope when said length of cable is increased in length between said anterior bracket and said posterior bracket connected under said medial longitudinal arch curve.

7. The arch support orthosis of Claim 1 wherein said means for tensioning

including:

said anterior bracket having a distal portion being connected under said anterior slope proximal to said medial side, said anterior bracket having a proximal portion extended downwardly from said anterior slope;

said posterior bracket having a distal portion being connected under said posterior slope proximal to said medial side, said posterior bracket having a proximal portion extended downwardly from said posterior slope; and

two straps of non-extendable web materials; each of said straps having a distal end attached to said respective anterior bracket and posterior bracket, each of said straps having a proximal end connectable together by a means for adjusting positioned under said medial longitudinal arch curve.

8. The arch support orthosis of Claim 7 wherein said means for tensioning further including said means for adjusting being manipulated by the user for adjustment of the length between said anterior bracket and said posterior bracket.

9. The arch support orthosis of Claim 8 wherein said means for adjusting including a worm gear, a buckle, or a clamp.

10. A foot support orthosis including an arch support brace having an arch curve being variably tensioned during use, the foot support orthosis being fittable underneath the foot and being sized and shaped to be removably placed proximal a foot supporting surface of a foot enclosure worn by a user, comprising:

an orthosis being sized for support of the foot from underneath about the metatarsal bones of the foot, to underneath about the calcaneus bone of the foot, said orthosis having a first surface being contoured for support of the foot, having a second surface being downwardly faced for contact with the foot supporting surface of the shoe, and having a medial side and a lateral side on opposed sides of a central longitudinal midline of said orthosis;

a forefoot portion of said first surface being arcuately shaped to be positionable underneath the metatarsal bones of the foot;

a heel portion of said first surface being arcuately shaped to be positionable underneath the calcaneus bone of the foot;

a medial longitudinal arch curve proximate said medial side of said orthosis, said medial longitudinal arch curve being shaped to be positionable underneath the arch of the foot, said medial longitudinal arch curve having an upper surface being curved upwardly along a crown portion, said medial longitudinal arch curve including:

an anterior slope being inclined from said upper surface of said medial longitudinal arch curve toward said forefoot portion of said orthosis;

a posterior slope being inclined from said upper surface of said medial longitudinal arch curve toward said heel portion of said orthosis; and

a medial slope being inclined from said upper surface of said medial longitudinal arch curve toward said lateral side of said orthosis; and

said anterior slope having an anterior base of a first thickness, said posterior slope having a posterior base of a second thickness, said crown of said medial slope having a third thickness along said upper surface of said medial longitudinal arch curve, said medial side of said medial longitudinal arch curve being disposed in a continuous arched curve along a length dimension of said medial side;

whereby said medial longitudinal arch curve having said anterior base, said crown portion, and said posterior base being tensioned during each foot-strike by force being transferred by the foot of the user from said heel portion and onto said medial longitudinal arch curve of said orthosis, thereby increasing the tension along said medial longitudinal arch curve without significantly decreasing the height of the arch curve, with said crown portion of said medial longitudinal arch curve flexibly rebounded to an unweighted position by force being transferred by the foot of the user from said medial longitudinal arch curve and onto said forefoot portion of said orthosis during each foot-strike by the user while wearing said orthosis.

11. The foot support orthosis of Claim 10 further comprising a means for

tensioning connectable underneath said arch curve, said means for tensioning including:

an anterior bracket being L-shaped, said anterior bracket having a distal portion being connected under said anterior slope proximal to said medial side, said anterior bracket having a proximal portion extended downwardly from said anterior slope;

a posterior bracket being L-shaped, said posterior bracket having a distal portion being connected under said posterior slope proximal to said medial side, said posterior bracket having a proximal portion extended downwardly from said posterior slope;

an anterior linkage aligned with said anterior bracket, said anterior linkage having a distal end pivotably connected with said proximal portion of said anterior bracket, said anterior linkage having a proximal end disposed underneath said crown portion of said medial longitudinal arch curve;

a posterior linkage aligned with said posterior bracket, said posterior linkage having a distal end pivotably connected with said proximal portion of said posterior bracket, said posterior linkage having a proximal end disposed underneath said crown portion of said medial longitudinal arch curve; and

a means for adjusting the neutral length between said distal end of said anterior linkage and said distal end of said posterior linkage, said means for adjusting having opposed ends being disposed to accept therein respectively said proximal ends of

said anterior linkage and said proximal linkage, said means for adjusting being manipulated by the user;

whereby said anterior linkage and said posterior linkage are retracted into respective opposed ends of said means for adjusting, the length between said respective distal ends is shortened, each of said anterior and posterior linkages engage said each respective proximal portions of said anterior bracket and said posterior bracket, thereby each respective anterior and posterior brackets pivot respectively inwardly, thereby pulling said underside of said anterior slope and said posterior slope toward each other and increasing the tension along said medial longitudinal arch curve;

whereby when each of said anterior linkage and said posterior linkage is extended from said means for tensioning by manipulation of said means for adjusting, the length between said respective distal ends is lengthened, thereby each distal end extends against said respective proximal portions of said anterior bracket and said posterior bracket which pivot against the underside of said anterior slope and said posterior slope, thereby pushing said underside of said anterior slope and said posterior slope apart and reducing the tension of said medial longitudinal arch curve.

12. The foot support orthosis of Claim 10 further comprising a means for tensioning connectable underneath said arch curve, said means for tensioning including:

an anterior bracket connectable to said anterior base, said anterior bracket

having a distal portion being connected under said anterior base proximal to said medial side, said anterior bracket having a proximal portion extended toward said posterior base;

a posterior bracket connectable to said posterior base, said posterior bracket having a distal portion being connected under said posterior base proximal to said medial side, said posterior bracket having a proximal portion extended toward said anterior base;

an anterior linkage aligned with said anterior bracket, said anterior linkage having a distal end pivotably connected with said proximal portion of said anterior bracket, said anterior linkage having a proximal end disposed underneath said crown portion of said medial longitudinal arch curve;

a posterior linkage aligned with said posterior bracket, said posterior linkage having a distal end pivotably connected with said proximal portion of said posterior bracket, said posterior linkage having a proximal end disposed underneath said crown portion of said medial longitudinal arch curve; and

a means for adjusting the neutral length between said distal end of said anterior linkage and said distal end of said posterior linkage, said means for adjusting having opposed rod ends being disposed to connect in an anterior swiveling connection to said proximal end of said anterior linkage and in a posterior swiveling connection to said proximal end of said proximal linkage, said means for adjusting being manipulated by the user to retract or extend each of said opposed rod ends;

whereby when said opposed rod ends are retracted into respective opposed

ends of said means for adjusting, the length is shortened between said respective distal ends of said anterior and posterior linkages, each of said anterior and posterior linkages engage said respective proximal portions of said anterior and posterior brackets, thereby each respective anterior and posterior brackets retract respectively toward said means for adjusting, thereby pulling said underside of said anterior base and said posterior base toward each other and increasing the tension along said medial longitudinal arch curve;

whereby when said opposed rod ends are extended into respective opposed ends of said means for adjusting, the length is lengthened between said respective distal ends of said anterior and posterior linkages, each of said anterior and posterior linkages engage said respective proximal portions of said anterior and posterior brackets, thereby each respective anterior and posterior brackets retract respectively away from said means for adjusting, thereby pushing said underside of said anterior base and said posterior base away from each other and reducing the tension of said medial longitudinal arch curve.

13. A foot support orthosis including an arch curve being variably tensioned during use, the foot support orthosis being fittable underneath the foot and being sized and shaped to be removably placed proximal a foot supporting surface of a foot enclosure worn by a user, comprising:

an orthosis being sized for support of the foot from underneath about the metatarsal bones of the foot, to underneath about the calcaneus bone of the foot, said

orthosis having a first surface being contoured for support of the foot, having a second surface being downwardly faced for contact with the foot supporting surface of the shoe, and having a medial side and an outer lateral side on opposed sides of a central lengthwise midline of said orthosis;

a forefoot portion of said first surface of said orthosis being arcuately shaped to be positionable underneath the metatarsal bones of the foot;

a heel portion of said first surface of said orthosis being arcuately shaped to be positionable underneath the calcaneus bone of the foot;

a medial longitudinal arch curve having an upper surface being curved upwardly along a crown portion, said medial longitudinal arch curve including:

an anterior slope being inclined from said upper surface of said medial longitudinal arch curve toward said forefoot portion of said orthosis;

a posterior slope being inclined from said upper surface of said medial longitudinal arch curve toward said heel portion of said orthosis; and

a medial slope being inclined from said crown portion of said upper surface of said medial longitudinal arch curve toward said lateral side of said orthosis; and

said anterior slope having an anterior base of a first thickness, said posterior

slope having a posterior base of a second thickness, said crown of said medial slope having a third thickness along said upper surface of said medial longitudinal arch curve, said medial side of said medial longitudinal arch curve being disposed in an arched curve along a length dimension of said medial side;

whereby said medial longitudinal arch curve having said anterior base, said crown portion, and said posterior base being tensioned during each foot-strike by force being transferred by the foot of the user from said heel portion and onto said medial longitudinal arch curve of said orthosis, thereby increasing the tension along said medial longitudinal arch curve without significantly decreasing the height of the arch curve, with said crown portion of said medial longitudinal arch curve flexibly rebounded to an unweighted position by force being transferred by the foot of the user from said medial longitudinal arch curve and onto said forefoot portion of said orthosis during each foot-strike by the user while wearing said orthosis; and

a means for tensioning said medial longitudinal arch curve connectable between an underside portion of said anterior slope and an underside portion of said posterior slope, said means for tensioning having a means for adjusting being manipulated by a user for adjustment of a length of said means for tensioning between a neutral length, a decreased length, and an extended length between said anterior slope and said posterior slope,

whereby when the neutral length of said means for tensioning is reduced to the

decreased length by the user adjustment of said means for adjusting, the tension along said medial longitudinal arch curve is increased thereby the stiffness of said arch curve increases from when said means for tensioning is at the neutral length, and each slope of said anterior slope and said posterior slope is increased, and when the neutral length of said means for tensioning is increased to the extended length by the user adjustment of said means for adjusting, the tension along said medial longitudinal arch curve is decreased, and each slope of said anterior slope and said posterior slope is decreased.

14. The foot support orthosis of Claim 13 wherein said first thickness of said anterior base of said anterior slope is substantially equal to said second thickness of said posterior base of said posterior slope, said third thickness of said medial slope and said crown being less than the first and second thickness.

15. The foot support orthosis of Claim 13 wherein said first thickness of said anterior base of said anterior slope is less than said second thickness of said posterior base of said posterior slope, and said third thickness of said medial slope and said crown being less than the first and second thickness.

16. The foot support orthosis of Claim 13 wherein said means for tensioning including:

an anterior bracket being L-shaped, said anterior bracket having a distal portion being connected under said anterior slope proximal to said medial side, said anterior bracket having a proximal portion extended downwardly from said anterior slope;

a posterior bracket being L-shaped, said posterior bracket having a distal portion being connected under said posterior slope proximal to said medial side, said posterior bracket having a proximal portion extended downwardly from said posterior slope;

an anterior linkage aligned with said anterior bracket, said anterior linkage having a distal end pivotably connected with said proximal portion of said anterior bracket, said anterior linkage having a proximal end disposed underneath said crown portion of said medial longitudinal arch curve;

a posterior linkage aligned with said posterior bracket, said posterior linkage having a distal end pivotably connected with said proximal portion of said posterior bracket, said posterior linkage having a proximal end disposed underneath said crown portion of said medial longitudinal arch curve; and

said means for adjusting the neutral length between said distal end of said anterior linkage and said distal end of said posterior linkage, said means for adjusting having opposed ends being disposed to accept therein respectively said proximal ends of said anterior linkage and said proximal linkage, said means for adjusting being

manipulated by the user;

whereby said anterior linkage and said posterior linkage are retracted into respective opposed ends of said means for adjusting, the length between said respective distal ends is shortened, each of said anterior and posterior linkages engage said each respective proximal portions of said anterior bracket and said posterior bracket, thereby each respective anterior and posterior brackets pivot respectively inwardly, thereby pulling said underside of said anterior slope and said posterior slope toward each other and increasing the tension along said medial longitudinal arch curve; and

whereby when each of said anterior linkage and said posterior linkage is extended from said means for tensioning by manipulation of said means for adjusting, the length between said respective distal ends is lengthened, thereby each distal end extends against said respective proximal portions of said anterior bracket and said posterior bracket which pivot against the underside of said anterior slope and said posterior slope, thereby pushing said underside of said anterior slope and said posterior slope apart and reducing the tension of said medial longitudinal arch curve.

17. The foot support orthosis of Claim 13 wherein said means for tensioning including:

an anterior bracket connectable to said anterior base, said anterior bracket having a distal portion being connected under said anterior base proximal to said medial

side, said anterior bracket having a proximal portion extended toward said posterior base;

a posterior bracket connectable to said posterior base, said posterior bracket having a distal portion being connected under said posterior base proximal to said medial side, said posterior bracket having a proximal portion extended toward said anterior base;

an anterior linkage aligned with said anterior bracket, said anterior linkage having a distal end pivotably connected with said proximal portion of said anterior bracket, said anterior linkage having a proximal end disposed underneath said crown portion of said medial longitudinal arch curve;

a posterior linkage aligned with said posterior bracket, said posterior linkage having a distal end pivotably connected with said proximal portion of said posterior bracket, said posterior linkage having a proximal end disposed underneath said crown portion of said medial longitudinal arch curve; and

said means for adjusting the neutral length between said distal end of said anterior linkage and said distal end of said posterior linkage, said means for adjusting having opposed rod ends being disposed to connect in an anterior swiveling connection to said proximal end of said anterior linkage and in a posterior swiveling connection to said proximal end of said proximal linkage, said means for adjusting being manipulated by the user to retract or extend each of said opposed rod ends;

whereby when said opposed rod ends are retracted into respective opposed ends of said means for adjusting, the length is shortened between said respective distal

ends of said anterior and posterior linkages, each of said anterior and posterior linkages engage said respective proximal portions of said anterior and posterior brackets, thereby each respective anterior and posterior brackets retract respectively toward said means for adjusting, thereby pulling said underside of said anterior base and said posterior base toward each other and increasing the tension along said medial longitudinal arch curve;

whereby when said opposed rod ends are extended into respective opposed ends of said means for adjusting, the length is lengthened between said respective distal ends of said anterior and posterior linkages, each of said anterior and posterior linkages engage said respective proximal portions of said anterior and posterior brackets, thereby each respective anterior and posterior brackets retract respectively away from said means for adjusting, thereby pushing said underside of said anterior base and said posterior base away from each other and reducing the tension of said medial longitudinal arch curve.

18. A method of supporting an arch curve of a foot of a user for treating inflamation in the user's foot , the inflamation proximate the arch curve of the foot and related to heel spurs, plantar fasciitis, arch pain, tendinitis, and/or metatarsalgia in the foot, each foot of the user being supported by a supporting surface within respective foot support enclosures, comprising the steps of:

providing an arch support orthosis including an adjustable medial longitudinal arch curve being adjustable in slope and tension along said arch curve, said arch support

orthosis being sized and shaped for removably fitting underneath the arch curve of the user's foot;

adjusting a tensioning means having a means for adjusting connected to an underside of an anterior slope and a posterior slope of said medial longitudinal arch curve, said adjusting step providing a first tension along said medial longitudinal arch curve;

inserting said arch support orthosis underneath the foot of the user and upon the supporting surface of the foot support enclosure;

bearing force from the foot of the user onto said medial longitudinal arch curve of said arch support orthosis during each foot-strike by the foot of the user;

tensioning said medial longitudinal arch curve during each foot-strike, said tensioning means limiting said medial longitudinal arch curve from being compressed in height thereby supporting the arch curve of the user's foot during each foot-strike;

readjusting said means for adjusting to a second tension thereby reducing tension along said adjustable medial longitudinal arch curve, whereby the user's arch curve is continuously supported by said adjustable medial longitudinal arch curve; and

selecting a preferred angle of the anterior slope and a preferred angle of the posterior slope, and maintaining the tension along the medial longitudinal arch curve by shortening or lengthening the length of the tensioning means by manipulating said means for adjusting.

19. The method of supporting of Claim 18, further comprising the steps of:

readjusting at periodic time increments the angle of the anterior slope, the angle of the posterior slope, and the height of the medial longitudinal arch curve by shortening or lengthening the length of the tensioning means by user manipulating of the tensioning means;

removing and re-inserting said arch brace in the shoe, boot, or sandal of the preference of the user; and

providing user adjustable height support, user adjustable angle of the anterior slope, and user adjustable angle of the posterior slope when said removing and re-inserting step is repeated;

whereby said adjusting step and said readjusting steps reduce the inflamation in the foot and strengthen the arch curve of the foot of the user, and said removing and re-inserting steps provide adjustable tension of the arch curve, anterior slope support, and posterior slope support for the arch curve of the foot of the user for each shoe enclosure worn by preference of the user.